[0093] FIG. 9 is a block diagram illustrating an exemplary logical flow for performing on-device learning to estimate what link energy usage would be based on current conditions at a wireless device, according to some embodiments.

[0094] As shown, information regarding energy consumption (e.g., from a baseband power consumption estimating module), channel conditions, and the amount of data (e.g., number of bytes) transferred may be collected by an on-device learning algorithm when the wireless device has an active data connection. Note that other information (e.g., location, time, etc.) associated with such information may also be gathered by the on-device learning algorithm, as desired.

[0095] The on-device learning algorithm may generate an energy cost table or database indicating estimated link energy usage values for various combinations of conditions that might be experienced by the wireless device, based on the information collected regarding historical energy usage under various conditions. For example, the energy cost table/database might indicate an estimated link energy cost for a hypothetical wireless link that operates at each possible combination of values for a range of possible values for each of channel conditions, load conditions, and locations.

[0096] Thus, by determining the current channel conditions, load conditions, and location of the wireless device, the wireless device may in turn be able to determine a link energy metric value for the wireless device using (e.g., looking up the current conditions in) such an energy cost table/database. Such a metric may be used to select baseband operation timing opportunistically, e.g., to perform data communication when the value of the link energy metric is favorable, and/or to defer data communication when the value of the link energy metric is unfavorable. Similarly, such a metric may be used by higher layer (e.g, application, network, and/or transport layers) operations to opportunistically perform network data exchanges when the link energy metric is favorable, and/or to defer network data exchanges when the value of the link energy metric is unfavorable.

[0097] Note that since the data used to generate the energy cost table/database may be collected from the device itself, the energy cost estimates may be device specific. For example, as the energy cost table/database may be based on data resulting from the particular habits and patterns of use of the wireless device, the link energy metric values may more closely represent the actual link energy efficiency experienced by the wireless device than a generic energy cost table/database generated in aggregate might, at least according to some embodiments.

[0098] FIG. 10 further illustrates exemplary aspects of a possible on-device learning algorithm that estimates what link energy usage would be based on current conditions at a wireless device, according to some embodiments.

[0099] An active data connection may have numerous characteristics that vary over time, including power consumption, signal level (e.g., RSRP in LTE), serving cell load, and throughput, among other possible characteristics. The graphs illustrated in FIG. 10 illustrate possible value variations for such characteristics over an example time sample.

[0100] A learning algorithm may accumulate associated sample values of such characteristics as the data connection is used at different times, in different places, for different types of data exchange, etc. The learning algorithm may use one or more learning techniques (such as a genetic algorithm, among various possibilities), to analyze how the variations in values of such characteristics are correlated together based on the obtained sample values for such characteristics, and thereby build a table (as shown) or other model to build an energy metric mapping indicating an expected energy cost per data communicated under various possible conditions with respect to the characteristics monitored.

[0101] Embodiments of the present disclosure may be realized in any of various forms. For example some embodiments may be realized as a computer-implemented method, a computer-readable memory medium, or a computer system. Other embodiments may be realized using one or more custom-designed hardware devices such as ASICs. Still other embodiments may be realized using one or more programmable hardware elements such as FPGAs.

[0102] In some embodiments, a non-transitory computer-readable memory medium may be configured so that it stores program instructions and/or data, where the program instructions, if executed by a computer system, cause the computer system to perform a method, e.g., any of a method embodiments described herein, or, any combination of the method embodiments described herein, or, any subset of any of the method embodiments described herein, or, any combination of such subsets.

[0103] In some embodiments, a device (e.g., a UE 106) may be configured to include a processor (or a set of processors) and a memory medium, where the memory medium stores program instructions, where the processor is configured to read and execute the program instructions from the memory medium, where the program instructions are executable to implement any of the various method embodiments described herein (or, any combination of the method embodiments described herein, or, any subset of any of the method embodiments described herein, or, any combination of such subsets). The device may be realized in any of various forms.

[0104] Although the embodiments above have been described in considerable detail, numerous variations and modifications will become apparent to those skilled in the art once the above disclosure is fully appreciated. It is intended that the following claims be interpreted to embrace all such variations and modifications.

What is claimed is:

1. An apparatus for controlling power consumption of a user equipment device (UE), the apparatus comprising:
a processor configured to cause the UE to:
estimate a power and/or energy consumption associated with downlink communication activity of the UE;
select, based on the estimated power and/or energy consumption, a first receiver configuration for the UE for a first time period;
receive, during the first time period, a downlink communication using the first receiver configuration.

2. The apparatus of claim **1**, wherein the power and/or energy consumption is the power and/or energy consumption of a baseband processor of the UE.

3. The apparatus of claim **1**, wherein selecting the first receiver configuration includes determining whether to activate or deactivate an advanced receiver function.

4. The apparatus of claim **3**, wherein the advanced receiver function relates to interference mitigation.